UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/663,218	09/15/2003	David Abercrombie	02-5695 81564	3751

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ART UNIT	PAPER NUMBER
2129	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

	Application No.	Applicant(s)
Office Action Summary	10/663,218	ABERCROMBIE ET AL.
	Examiner	Art Unit	
	Bharadwaj Kalpana	2129	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☒ This action is **FINAL**.   2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14* is/are pending in the application.

     4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-14* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 September 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

     a)☐ All   b)☐ Some * c)☐ None of:

         1.☐ Certified copies of the priority documents have been received.

         2.☐ Certified copies of the priority documents have been received in Application No. _____.

         3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

     * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☐ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☒ Information Disclosure Statement(s) (PTO/SB/08)
     Paper No(s)/Mail Date *09/15/2003*.

4)☐ Interview Summary (PTO-413)
     Paper No(s)/Mail Date. _____ .

5)☐ Notice of Informal Patent Application

6)☐ Other: _____ .

DETAILED ACTION

1.   This Office Action is in response to an AMENDMENT entered May 11,

2007 for the patent application 10/663,218 filed on Sept 15, 2003.

2.   All prior office actions are fully incorporated into this Office Action by

reference.

Status of Claims

3.   Claims 1-14 are pending. Claims 1-14 are rejected.

Claim Rejections - 35 USC § 101

4.   35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or
composition of matter, or any new and useful improvement thereof, may obtain a patent
therefor, subject to the conditions and requirements of this title.

5.   Claims 8-14 rejected under 35 *USC § 101*, as set forth in the previous

office action.

Response to Arguments

Applicant's arguments filed on May 11, 2007 related to Claims 8-14 on

page 6, with respect to the rejections under 35 U.S.C. § 101 have been fully

considered and are persuasive. The rejections of claims 8-14 under 35 U.S.C. §

101 have been withdrawn.

Claim Rejections - 35 USC § 102

6.   The following is a quotation of the appropriate paragraphs of 35

U.S.C. 102 that form the basis for the rejections under this section made in this

Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7.   Claims 1 and 8 are rejected under 35 U.S.C. 102(b) as being anticipated

by Wang (USPN 5,859,964, referred to as **Wang**).

As to **claims 1, 8**, Wang teaches a method of isolating sources of

variance in parametric data comprising (a medium and a computer program to

perform) steps of:

receiving a data set of measurements for a plurality of physical

parameters (**Wang**, Fig 1: data acquisition device);

cleaning the data set to remove measurements that may introduce error

(**Wang**, C 01 L55: collect process parameter data and analyze the data for

abnormality or fault);

generating a principal component analysis basis (**Wang**, C 14 L 13:

Principal Component Analysis; C 14 L 40: PCA technique is used; **EN**: basis is a

vector generated from PCA) from the cleaned data set;

estimating an independent component analysis model (**Wang**, C 09 L 06:

model is a Principal Component Analysis model) from the principal component

analysis basis;

calculating percentages of variance for the plurality of parameters (**Wang,**

C 14 L 13-16: PCA enables reduction of a data set while retaining most of its

variation) explained by each component in the estimated independent

component analysis model;

removing a component from the principal component analysis (**Wang**, Fig

3B: PCA model, fault detector, alarm file, lot report) basis when the calculated

percentages of variance indicate that the component is a minor component,

(**Wang,** C 14 L 14: new set of variables derived from transformations; **EN**:

calculating variance to decide if a component is minor is a step during variable

transformations);

and

generating as output the estimated independent component analysis

model excluding the minor component. (**Wang**, Abstract: detecting faults; C14 L

17: new variables are statistically uncorrelated; **EN**: To detect faults using PCA

models, it is inherent that one would eliminate minor components (variables) that

are statistically uncorrelated.); and

identifying a physical mechanism corresponding to a significant

component of the estimated independent component analysis model (**Wang**, C04

L01-11: notification of the detected fault; C14 L07-23: generating a signal health

value).

Response to Arguments

8.   Applicant's arguments filed on May 11, 2007, related to claims 1 and 8

have been fully considered but are not persuasive.

9.   In reference to Applicant's argument on page 7:

Is "analyzing data to detect a fault condition as described in Wang,

equivalent to cleaning data, as explained in the specification to mean

omitting abnormal samples from the data set to avoid introducing error?"

Examiner's response:

It would be abundantly clear to one of ordinary skill in the art to see that "cleaning

to omit abnormal samples" is equivalent to "analyzing to detect a fault". PCA is

used for principal component <u>analysis</u> in both cases, although the applicant has

chosen to use the word "cleaning".

10.   In reference to Applicant's argument on page 7:

Does Wang disclose identifying a corresponding physical mechanism from

the estimated independent component analysis model?

Examiner's response:

Wang discloses several embodiments that identify a corresponding physical

mechanism from the estimated independent component analysis model. For

example, generating a signal health value for each of the process parameter

signals (**Wang**, C14 L07-23).

11.   In reference to Applicant's argument on page 8:

Is it true (as the applicant has argued), "that deriving a new set of

variables from transformations is not equivalent to removing a minor

component?"

Examiner's response:

Deriving a new set of variables from transformations (using PCA) is to reduce the

number of dimensions, or compress the data, which results in removing a minor

(or insignificant) component. Hence, they are equivalent.

12.   In reference to Applicant's argument on page 8:

Is it true (as the applicant has argued), "that detecting faults from a new

set of variables from transformations does not <u>necessarily</u> include

removing a minor component?"

Examiner's response:

¶ 19 applies.

Claim Rejections - 35 USC § 103

13.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for

all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described
> as set forth in section 102 of this title, if the differences between the subject matter sought to
> be patented and the prior art are such that the subject matter as a whole would have been
> obvious at the time the invention was made to a person having ordinary skill in the art to which
> said subject matter pertains. Patentability shall not be negatived by the manner in which the
> invention was made.

14.   Claims 2, 3, 9 and 10 are rejected under 35 U.S.C. 103(a) as being

unpatentable over Wang as applied to claims 1 and 8 above, and further in view

of Agarwal (USPN 7,006,205 B2, referred to as **Agarwal**).

As to **claims 2, 9**, Wang teaches the method of claim 1 but does not teach

the calculated percentages of variance indicating that a component is a minor

component when a percentage of variance for each of the plurality of parameters

explained by the component is less than a minimum percentage of variance for a

single parameter. However, Agarwal teaches reducing data based on variation

(**Agarwal**, C 03 L 42-50: inputs can be reduced using PCA algorithm; **Fig.3**:

variance as a percentage of total based upon the number of principal

components). It would be obvious for one skilled in the art to combine the two

references because they are both from the same field of endeavor, ie. using PCA

for semiconductor applications. The teachings of Wang can be modified to add

variations as a percentage, thus optimizing the variations for the benefit of finding

insignificant components.

As to **claims 3, 10**, Wang as modified by Agarwal in claim 2 teaches the

method of claim 1, the calculated percentages of variance (**Agarwal**, C 09 L 32:

variance as a percentage) indicating that a component is a minor component when (**Agarwal,** C 09 L 42: quantity of data may be significantly reduced) an average percentage of variance for the plurality of parameters explained by the component is less than a minimum average percentage of variance.

It would be obvious for one skilled in the art to see that the PCA model for detecting faults in fabrication can be further optimized by calculating insignificant components based on percentages of variance.

15.   Claims 4-7 and 11-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang as applied to claims 1 and 8 above, and further in view of Heavlin (USPN 6,389,366, referred to as **Heavlin**).

As to **claims 4, 11**, Wang teaches the method of claim 1 further comprising a step of calculating confidence intervals (**Wang,** C02 L 63: indication of the relative conformance). Wang does not teach confidence intervals for rotation angles of the estimated independent component analysis model. However, Heavlin teaches rotation angles (**Heavlin,** C 02 L 67: Each element of the rotation matrix gives the rotation angle). It would be obvious to one with ordinary skilled in the art to combine the two references because they both relate to technology and methods in wafer fabrication. Further, it would have been obvious to one with ordinary skills in the art to add a rotation matrix to give the rotation angles to Wang's process model because this would result in compact representation of data for improved fault detection.

As to **claims 5, 12**, Wang does not teach the method of claim 4 further comprising a step of labeling a component of the estimated independent component analysis model to correspond to a specific physical process.

However, labeling is a primitive function and it would be obvious for one skilled in the art to label a component corresponding to a specific process in order to identify the component readily.

As to **claims 6, 13**, Wang does not teach the method of claim 5 further comprising a step of labeling the component as critical dimension of gate width effect on device drive current, critical dimension of gate width effect on device threshold voltage, critical dimension of gate length effect, implant dose effect, and gate oxide thickness effect.

However, it would be obvious to one skilled in the art because labeling a component based on criteria mentioned above has the benefit of assigning significance to components corresponding to specific fabrication processes in Wang's application.

As to **claims 7, 14**, Wang does not teach the method of claim 5 further comprising a step of examining the labeled component to identify the corresponding physical mechanism associated with the specific physical process.

However, it would be obvious to one skilled in the art to add labeling

components to identify physical components to Wang's fabrication processes

because this will help isolate the corresponding processes.

Response to Argument

16.   Applicant's arguments filed on May 11, 2007, related to claims 4-7 and 11-

14 have been fully considered but are not persuasive.

17.   In reference to Applicant's argument on page 9:

Is the claimed rotation angles of the estimated independent component

analysis model, disclosed by Heavlin?

Examiner's response:

As per the applicant's disclosure, a 'rotation angle" is the displacement angle

used to calculate a desired confidence interval. Heavlin discusses a rotation

angle rotated to realize the most similar pattern (**Heavlin**, C02 L60- C03 L05).

To one of ordinary skill in the art, 'a desired confidence interval' could be

achieved by 'realizing the most similar pattern' and 'rotation' would be reduced to

a rotation of the co-ordinate system, in both the reference and the applicant's

system. Hence, they are equivalent in mathematical terms.

Examination Considerations

18.   Examiner has cited particular columns and line numbers or paragraph

numbers in the references applied to the claims above for the convenience of the

applicant. Although the specified citations are representative of the teachings of

the art and are applied to specific limitations within the individual claim, other

passages and figures may apply as well. It is respectfully requested from the

Applicant in preparing responses, to fully consider the references in their entirety

as potentially teaching all or part of the claimed invention, as well as the context

of the passage as taught by the prior art or disclosed by the Examiner. The

entire reference is considered to provide disclosure relating to the claimed

invention.

19.   The Examiner has full latitude to interpret each claim in the broadest

reasonable sense.

Conclusion

20.   Applicant's amendment necessitated the new ground(s) of rejection

presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.**

See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as

set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire

THREE MONTHS from the mailing date of this action. In the event a first reply is

filed within TWO MONTHS of the mailing date of this final action and the advisory

action is not mailed until after the end of the THREE-MONTH shortened statutory

period, then the shortened statutory period will expire on the date the advisory

action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be

calculated from the mailing date of the advisory action. In no event, however, will

the statutory period for reply expire later than SIX MONTHS from the date of this

final action.

Any inquiry concerning this communication or earlier communications from

the examiner should be directed to Bharadwaj Kalpana whose telephone number

is (571) 270-1641. The examiner can normally be reached on Monday-Friday

7:30am 5:00 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the

examiner's supervisor, David Vincent can be reached on (571) 272-3080. The

fax phone number for the organization where this application or proceeding is

assigned is 571-273-8300.

Information regarding the status of an application may be obtained from

the Patent Application Information Retrieval (PAIR) system. Status information

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PAIR. Status information for unpublished applications is available through

Private PAIR only. For more information about the PAIR system, see http://pair-

direct.uspto.gov. Should you have questions on access to the Private PAIR

system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-

free). If you would like assistance from a USPTO Customer Service

Representative or access to the automated information system, call 800-786-

9199 (IN USA OR CANADA) or 571-272-1000.

KB

July 22, 2007

DAVID VINCENT
SUPERVISORY PATENT EXAMINER